LONG TERM STEWARDSHIP
SAFETY SYSTEMS AND INSTITUTIONAL CONTROLS
January 21-22, 2002
Dallas, Texas

SS&IC Workgroup Members

Name	Employer	Phone	E-Mail
Brandon, Norman	Creative Concepts	Not available	Not available
French, David	Aspen Resources	Not available	Not available
Johnson, David	University of Oklahoma Health Sciences Center	Not available	Not available
Mohatt, James (Chair)	JVM and Associate	Not available	Not available
Paine, Donald	Nuclear Fuel Services, Inc.	Not available	Not available
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Stapp, Darby	Pacific Northwest National Lab	Not available	Not available
Braase, Lori LTS Facilitator	BBWI/INEEL	Not available	Not available

Action Items

#	Action	Designee	Date Due
1	Determine what has been done in the capability area and talk to colleagues about the application and possible technologies. (Applies to the yellow capability form). Forward information to Jim Mohatt.	Capability Owners	3/1/02
2	Identify stakeholders in your community that would be interested in attending the March LTS meeting. • Stakeholder – regulator. • Recognized community group. • Someone who would be impacted. • Someone who would be willing to come to the meeting. • Knowledgeable. • R&D university "types." Forward the names to Jim Mohatt.	SS&IC Team	2/15/02
3	Keep the team informed over the next two months.	Jim Mohatt	Ongoing

DISCUSSION INFORMATION GENERATED DURING THE MEETING

Assumptions

- A barrier, with some form of monitoring, will be in place.

- The Closure Plan will have characterized significant contaminants.

Issues/Opportunities

- The interface between the Safety Systems and Institutional Controls team and the Decision Making and Institutional Performance team were discussed and clarified in the following bullets:
  - The SS&IC Team will focus on the technical and hardware area of LTS. This also includes cultural regulation/rights and legal instruments.
  - The DM&IP Team will focus on organizational barriers and performance. This includes identifying and integrating the human side with the hardware side of LTS.

- The LTS plan must be in place prior to closure of the sites.

- DOE needs a strategy for transfer of LTS sites.
  - Ground rules
  - Recipient
  - Purveyor

- New legislation to establish and ensure the success of the LTS program. (Congressional act)

- How will long-term land use control be maintained?
  - Legal is one of the ways.

SS&IC Activities (Categorized brainstorm information)

1. Operations and Maintenance of Safety Systems
   - Establish access control (hardware, legal).
   - Monitor for intrusion (human, biological, e.g., the Hanford experience).
   - Provide warning for community risk.
   - Minimize people involvement.
   - Minimize dependence on people (reduce labor costs, reliability issue).
   - Minimize active involvement (responsibility).
   - Maintain integrity of safety systems.

- Ensure long-term monitoring and operation of safety systems at minimum costs.
- Require safety systems commensurate with the risk at LTS sites.
- Monitor for system failure (legal, social, and hardware).
- Establish site criteria (finite number of systems).
- Establish safety system types.
- Maximize the use of standardized and consistent safety systems.
- Incorporate flexibility.
- Ability to upgrade the system (ensure the upgrade capability is there).
- Establish action levels below risk.

2. Land Use (legal, ownership, and liability)
    - Transfer ownership to the final legal entity.
    - Preserve appropriate land use.
    - Determine ownership.
    - Develop liability alternatives to reduce exposure.
    - Monitor for system failure (legal, social, and hardware).
    - Establish action levels below risk.

3. Communication/Management Organization (credibility of institutional system)
    - Maintain knowledge.
    - Share lessons learned.
    - Provide warning for community risk.
    - Develop long-term funding mechanism.
    - Educate public.
    - Retain stakeholder involvement.
    - Gain credibility should be our goal (commitment from DOE, Congressional action/policy).
    - Receive input.

4. Stakeholder/Other
    - Ensure local involvement.
        - Local trustee level.
        - Operations and maintenance.

Responsible WG Member Don Paine

SS&IC - LTS S&T Roadmap Target Form

Program Activity: Develop and maintain integrity of access control and safety systems.

Technical Capability: Identify maintenance requirements and schedules.

Goal: [X] Reduce Cost [ ] Reduce Uncertainty [ ] Reduce Risk

Short-term(2008) Target: Optimize maintenance systems to reduce costs by 40% by 2008

Target Description:

Target Status: [X] Process/Method Exists [ ] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification: Reduce unnecessary maintenance or frequency of maintenance activity on access control or safety systems. Establish proceduralized Data Quality Objectives (DQO's) for each system and the overall system performance.

Mid-term(2014) Target:

Target Description:

Target Status: [ ] Process/Method Exists [ ] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification:

Long-term(2020) Target:

Target Description:

Target Status: [ ] Process/Method Exists [ ] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification:

Long Term Stewardship – Science and Technology Roadmap

February 15, 2002

Work Group: Safety Systems and Institutional Controls (SS/IC)

Program Activity: Develop and maintain integrity of access controls and safety systems.

Technical Capability: Identify maintenance requirements and schedules.

- **Target Description:** Optimize maintenance systems to reduce costs by 40% by 2008.

- **Status Justification:** Reduce unnecessary maintenance or frequency of maintenance activity on access control or safety systems. Establish proceduralized Data Quality Objectives (DQO's) for each system and the overall system performance.

Background:

The SS/IC Workgroup identified optimized maintenance systems as medium cost risk, high system reliability risk and high public perception risk. A well-defined and optimized maintenance program for safety systems/controls is imperative to overall cost reduction, reliability of system performance and increased confidence in public perception of long-term risk from potential migration of contaminants from sources left after site closure.

After site closure, there are multiple barrier/monitoring systems which will require long-term maintenance considerations:

1) Physical subsidence of shallow land burial sites.
2) Contaminate monitoring of leach recovery systems, aquifer plumes, and surface stability.
3) Long-term maintenance of vegetative coverage.

This will require not only remote data acquisition and in-field monitoring systems, but also physical topography and floral integrity. Systems complexity must be reduced and established both pre- and post-closure in a graded approach relative to the hazardous constituents remaining post site closure.

Needs:

The needs evaluated to date are based on those currently established at DOE's Fernald Environmental Management Project (FEMP). The Fernald site has been designated as one of DOE-HQ's critical sites to closure by 2006. The needs are as follows:

I. Passive Leachate Treatment and Monitoring Need

- Long-term, post-closure passive treatment of uranium contaminated leachate derived from the on-site disposal facility.
- Data quality objectives are surface water discharge limits of .02 mg U/L.
- Specific needs include: Bench scale testing program to test viability of passive treatment systems, list of currently available systems, information regarding long-term monitoring performance and maintenance requirements costs.

II. Meteorological Monitoring

- Automated meteorological station with remote data access capability.
- FEMP may require continuous collection of met data for monitoring the performance of the on-site disposal facility.
- Data quality objectives include those parameters to trend precipitation infiltration versus surface runoff.
- Specific needs include: 1) state of art design; 2) maintenance-free instrumentation; 3) reliability under extreme environmental conditions; 4) optimized calibration conditions during operating periods. In addition, the system should be wireless, remote, and capable of transmitting data over a long distance (i.e., 25 miles) to a remote data analysis and date repository location.

III. On-Site Disposal Facility Flow Monitoring

- Real time technology for the detection and quantification of flow volume in the leachate collection and leak detection system beneath each cell of the on-site disposal facility needs to support long-term monitoring post site closure.
- Data quality objectives must support quantification of flow volume for each cell and both safety systems on a monthly basis with flow rates in the gallons/acre/day.
- System must be remote, record information on a continuous basis, and remotely tied to a data acquisition and data repository location.
- System must be maintenance free and highly reliable.
- Innovative, automated, remote and low maintenance systems are required.

IV. On-Site Disposal Facility Leachate Quality Monitoring

- Real-time analytical technology for uranium and total organic halogens in water from the leachate collection and leak detection systems must support long-term, post-site closure time frame.
- Specific needs include: 1) automated in-line analytical system with remote access capability; 2) DQO's of 5 ug/L uranium and 25 ug/L total organic halogens; 3) future integration capability with leachate flow monitoring system.
- In addition, the system must be maintenance free, reliable and integrated into a remote data analysis and data repository system.

V. On-Site Disposal Cover System Monitoring

- Develop and implement a post-closure, long-term monitoring and reporting system for: 1) physical changes in the on-site disposal facility cover; 2) changes in the ecological system established for cell cover and surrounding buffer area; 3) changes in establishing real-time effectiveness of established institutional controls.
- Specific needs are: 1) monitoring of physical changes in the cover (monthly); 2) monitoring after cell caps have been installed for at least two years; 3) monitoring for at least three years post on-site disposal facility closure.
- Should also determine effectiveness of runon/runoff controls and drainage layer for at least three years post on-site disposal cell closure.
- Parameters of interest are:
    - Evidence of surface erosion such as gullets and/or deposition of sediment;
    - Changes in the moisture content profile in the vegetative layer;
    - Changes in the elevation contours, location and extent of the cover surface;
    - Changes in the vegetative layer thickness;
    - Changes in the vegetative cover and the penetration depth of its root system;
    - Extent of subsurface burrows produced by fauna; and
    - Conditions of surface water runon, runoff and drainage layer system.

- In addition, monitoring of institutional controls remotely should include:
    - Access load
    - Fencing
    - Signage
    - Valve houses
    - Lift stations
    - Biological/physical intrusion
    - Deed restrictions
    - Management of records/data information.

VI. Long-Term Data/Image Repository

- Develop, implement and manage (also upgrade) a remote data/image acquisition, storage and retrieval system for long-term stewardship needs.
- Specific needs are: 1) leachate management and leak detection; 2) site-specific meteorological conditions; 3) shallow land burial cover performance; 4) institutional control effectiveness; 5) capabilities to store and retrieve new monitoring and relevant historical data and documentation.
- Requires real-time access by regulators, DOE and stakeholders.
- A successful data/image repository must address the following:
    1) Identification of functional requirements.
    2) Data acquisition from multiple monitoring/control vendors.
    3) Monitoring must be real-time and integration required.
    4) Storage must be simple and easily maintainable.
    5) Data retrieval must be user friendly and graphically displayed.
    6) Must be real-time and remote.

VII. Other Potential Future Needs

- Automated technologies to monitor the following three primary areas of concern:

1) Ecological/Geochemical Parameters.
    a) Runoff from on-site ponds and Paddy's Run (creek).
    b) Erosion/runoff from soils remediation areas.
    c) Site perimeter groundwater characteristics.

2) Cell Integrity
    a) Moisture and groundwater intrusion in on-site disposal facility.
    b) Integrity of leachate collection system lines.
    c) On-site disposal facility penetration.
    d) Real-time leak detection system.

3) General Maintenance
    a) Long-term recordkeeping/data retrieval.
    b) X-ray system to examine cell.
    c) Technology to unplug leachate collection lines.

Summary:

Many maintenance systems currently exist and most are system specific. Integrated maintenance systems will be required, and will be based on Safety Systems/Institutional Controls established at each closure site. Systems will require remote access, remote monitoring and remote data acquisition and retrieval. Optimization can only be achieved after Safety System and Institutional Control Systems have been clearly identified and Data Quality objectives defined.

Responsible WG Member J. Mohatt/D. Johnson

SS&IC - LTS S&T Roadmap Target Form

Program Activity: Develop a finite number of generic, standardized, risk-based, efficient safety systems.

Technical Capability: Methodology for safety systems selection.

Goal: [X] Reduce Cost [X] Reduce Uncertainty [X] Reduce Risk

Short-term(2008) Target: Reduce capital and operational costs by 40%.

Target Description: Develop a methodology for the selection of safety systems in order to reduce capital and operational costs by 40%. Complete the draft methodology by 2004 and the final methodology by 2006.

Target Status: [ ] Process/Method Exists [X] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification: Selection decision processes have evolved to some extent through past closure efforts but have not been compiled and generalized for broad applicability. At present there is no established risk-based methodology for selecting safety systems, including binding land use controls, appropriate to the specific characteristics of a given site. The lack of binding land use controls is particularly problematic in that the inability to guarantee appropriate land uses over the long term increases the Department of Energy's future liability exposure. This requires additional reliance on engineering control and monitoring systems, thereby increasing both closure-related capital costs and post-closure LTS operations and maintenance costs for which the Department of Energy may be responsible under closure agreements.

Mid-term(2014) Target:

Target Description:

Target Status: [ ] Process/Method Exists [ ] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification:

Long-term(2020) Target:

Target Description:

Target Status: [ ] Process/Method Exists [ ] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification:

Long-Term Stewardship Science & Technology Roadmap

Safety Systems and Institutional Controls (SS/IC) Working Group

Program Activity: Develop a finite number of generic, standardized, risk-based, efficient safety systems.

Technical Capability: Methodology for safety systems selection.

Short-Term Target: Reduce capital and operational costs by 40%.

Target Description: Develop a methodology for the selection of safety systems in order to reduce capital and operational costs by 40%. Complete the draft methodology by 2004 and the final methodology by 2006.

Justification: Department of Energy sites that cannot be returned to unrestricted-use condition prior to closure will be subject to long-term stewardship (LTS) requirements until techniques become available that may permit their complete rehabilitation. Included in this stewardship will be engineering containment and control systems to prevent contaminant migration, monitoring and sensor systems to verify the continued effectiveness of containment systems and controls, access control and safety systems to prevent unauthorized persons from intentionally or unintentionally approaching vulnerable areas or pursuing inappropriate land uses that may result in increased public or environmental risk, and decision-making and institutional performance systems to receive and interpret information provided by the other systems and take action as appropriate to ensure protection of the public and the environment. Department of Energy LTS sites will vary widely in the nature and complexity of residual hazards and their associated engineering control and monitoring systems; however, it must be anticipated that residual-risk management at all LTS sites will require some form of restricted access to specific areas, facilities, or equipment.

At present there is no established risk-based methodology for selecting safety systems, including binding land use controls, appropriate to the specific characteristics of a given site. The lack of binding land use controls is particularly problematic in that the inability to guarantee appropriate land uses over the long term increases the Department of Energy's future liability exposure. This requires additional reliance on engineering control and monitoring systems, thereby increasing both closure-related capital costs and post-closure LTS operations and maintenance costs for which the Department of Energy may be responsible under closure agreements.

Needs: A risk-based methodology for selection of effective and fiscally efficient safety systems should be developed for use in pre-closure and LTS planning. This methodology should:

- Emphasize reliance on long-term land use controls implemented and maintained through binding legal instruments.

- Require identification of funding requirements and funding sources necessary to insure long-term effectiveness of safety systems and land use covenants.
- Minimize reliance on technologies that are subject to becoming obsolete or require substantial maintenance and other operating costs, and insure that these costs are included as selection considerations.
- Specifically identify acceptable risk criteria for specified hazards.
- Address cost-benefit considerations that include both short-term and long-term capital, operating, and liability costs of both the Department of Energy and subsequent stewards.

Maturity:

- Few legal instruments providing for binding, long-term land use covenants exist. Existing instruments are not uniform across all states, territories, and protectorates, and are subject to treaty agreements with the Tribes. An initial methodology may require state-by-state and tribe-by-tribe delineation of legal options. Federal legislation may be required to achieve a measure of national consistency in land use control agreements.
- Long-term LTS funding needs are poorly understood due to the relatively short Department of Energy experience in this area. In particular, there is little understanding of the future reliability and continuity of LTS funding streams, or the impact of unanticipated costs on the viability of those streams. An effective methodology will require identification of long-term LTS funding mechanisms providing a measure of flexibility in closure financing and an assurance of long-term funding reliability.
- Many safety and institutional control related barrier, sensor, monitoring, and other systems rely on technologies that may be expected to require substantial future maintenance and operating costs and eventual upgrade. Life cycle costs of these systems have not been consistently incorporated in site closure and LTS planning. The methodology should include techniques for estimating these life cycle costs and promoting them as system selection considerations.
- Specific criteria for determining acceptable levels of risk to persons and the environment are not generally available for site closure and LTS planning. The absence of defined acceptable risk criteria may require that control systems (including Safety and Institutional Control systems) be selected to provide minimal achievable risk or some other risk level that may not be acceptable to all stakeholders. An optimal methodology will require that consensus quantifiable risk criteria be developed.
- Cost-benefit considerations may be more heavily weighted toward near-term, and particularly closure-related, costs and benefits than is desirable. This is due in part to a lack of longer-term LTS cost information, and in part to near-term budget pressures. An effective methodology would require that costs and benefits be evaluated over a foreseeable period for which credible cost and benefit estimates, including intangibles, are achievable. Methods for performing such estimates require exploration.

Working Group: Safety Systems and Institutional Controls SS/IC)

Program Capability: Develop a finite number of generic, standardized, risk-based, efficient safety systems

Technical capability: Provide methodology for safety systems selection.
The Technical Capability is anticipated to reduce cost, reduce uncertainty and reduce risk.

Target Description: Develop a methodology for the selection of safety systems in order to reduce capital and operational costs by 40%. Complete the draft methodology by 2004 and the final methodology by 2006.

Justification: Prior to the turn over of the site(s) from closure to LTS, an array of detectors/monitors, must be deployed in a tailored or graded approach to provide real time detection and analysis of selected target/precursor contaminates (yet to be defined) which, provide, precise, reliable, with substantially reduced maintenance requirements, for the community at risk (CAR) [yet to be defined]. The detectors, would be capable of reducing the need for stationary laboratory sampling and analysis, provide the necessary level of replication, detection and precision to comply with the necessary protection tailored for CAR and site access area health sampling and monitoring requirements for the 2006 target contaminants. The array of detectors would be connected and integrated into a main risk data integrator [yet to be determined] which would include all data, to include those of ground water contaminants and other critical measurements. Although it is not anticipated that such an array of embedded instruments will entirely replace the regulatory need for “hand” collected and analyzed samples, it is the goal to reduce the number of stationary samples by 60% from anticipated and thereby reduce the associated labor costs by 40%.

The requirement is to protect the public from environmental insults, for those individuals who can gain access to formally restricted government property and for those individuals who are in the nearby and adjacent CAR. The importance of these protective and warning systems is founded in the fact that the existing administrative, social/ legal controls for keeping people out of “harms way” can be fractured over time. The fragility of local zoning laws and restrictive covenants are being, over time, changed or liberalized in response to economic or social pressures.

The need for the sensors or monitoring devices will be based upon sound epidemiological / scientific evidence and regulatory acceptance. A system of human health protection sensors must be implanted within the site access areas and the CAR, when turn over is conducted from closure to LTS. Considering the demonstrated lack of the lasting power of existing land use controls, this public health defense needs to be “shored up” with a new and more permanent legal tool for ensuring that these monitors, generated from this S&T roadmap, continue to be used. Given the existing flexibility of the land use controls in place today, the line of demarcation between the original site boundary and the CAR should be considered as no longer either distinguishable or even in effect over the next several decades. The responsibilities of the agencies/entities for stewardship will need to continue and, where possible and practical they will need to upgrade these imbedded systems. (Intergenerational turn over of critical system information will be required from the onset.)

Maintenance cost reductions and efficiencies for site institutional controls have been addressed in another target.

Needs:

- Provide a definition for the CARS of the 2006 site closures
- Provide instruments which can detect regulatory levels of contaminants which require 40% less manpower and 60% less stationary laboratory analysis by the year 2006
- Provide easily recognizable feedback or signal to the CAR, when sensors have met or exceeded action levels(as established by the LTS) within 30 minutes,
- Provide an upgraded legal instrument that ensures that essential monitoring devices receive a higher degree of maintenance and care over time.
- Establish an array of detectors that is commensurate with the risk and activity of the CAR, i.e., short term stay time, incidental visitations, part-time living, business and commerce (occupational exposure) or full-time residences.
- Provide credible precursor contaminants of concern for the nine sites to be closed by 2006.

Maturity:

1. Instruments, which can send a signal via RF to detect organics in the PPB range, are in existence and in use in the commercial environment. However, their existing application is somewhat different than our expectations. Significant adaptation would be required.

2. Small metal detectors, for thin film application, are available, and they could be adapted to provide wireless signal to data collection/ integration system.

JVM02/28/02

Responsible WG Member K. Peone

SS&IC - LTS S&T Roadmap Target Form

Program Activity: Optimize operational and technical management and administration.

Technical Capability: Maintain intergenerational database and respond as necessary.

Goal: ☐ Reduce Cost ☒ Reduce Uncertainty ☐ Reduce Risk

Short-term(2008) Target: Develop options to ensure the preservation of site information.

Target Description: Develop options to ensure the preservation of site information from generation to generation to ensure technical continuity and reduce uncertainty. The archival records ensure the management and administrative integrity regarding the science and technology for the long-term (generation to generation).

Examples: maps, archives, administrative records, blueprints, specifications

Target Status: ☐ Process/Method Exists ☒ Process/Method Being Pursued ☐ No Known Process/Method

Status Justification: There is a relatively inconsistent method of retaining information in a universal manner. The variation will make it challenging for future managers, operators, scientists, etc. to repair and improve the technology used.

Mid-term(2014) Target:

Target Description:

Target Status: ☐ Process/Method Exists ☐ Process/Method Being Pursued ☐ No Known Process/Method

Status Justification:

Long-term(2020) Target:

Target Description:

Target Status: ☐ Process/Method Exists ☐ Process/Method Being Pursued ☐ No Known Process/Method

Status Justification:

Work Group: Safety Systems and Institutional Controls

Program Activity: Optimize operational and technical management and administration.

Technical Capabilities: Maintain intergenerational database and respond as necessary.

Target Description: Develop options to ensure the preservation of site information from generation to generation to ensure technical continuity and reduce uncertainty. The archival records ensure the management and administrative integrity regarding the science and technology for the long-term (generation to generation).

Status Justification: There is a relatively inconsistent method of retaining information in a universal manner. The variation will make it challenging for future managers, operators, and scientists, etc...to repair and improve the technology used.

The SS/IC Workgroup identified the capability for developing a intergenerational database as an opportunity that has high ratings in the areas of cost, uncertainty and risk. Developing an intergenerational database would reduce costs by eliminating the need to reproduce the science and technology when repairs and improvements are made to LTS sites. In turn, it would have a positive impact on the uncertainty, therefore minimizing the *risk* by providing reliable and accurate data regarding the site closure and cleanup processes and procedures.

COGENT STORY:

There are numerous stories regarding the lack of communication, or the upkeep of information regarding the closure and cleanup of a site, protecting people, securing a cleanup site, and preserving the method and/or technology used to cleanup a particular site. Some examples:

- At an unnamed site, the scenario was a cleanup site, a dump capped, and an operator. The operator was asked to take a bulldozer to a new by forest for clearing, the operator was not aware of the capped dump within the vicinity of the forest. As a result, he dozes over the site causing substantial damage.

- It has been noted that numerous times, operators from utility department (state and local) open up underground utilities resulting in the exposure of contaminated materials. Then it was discover after the fact, costing money, human risk, and decontamination costs.

- Numerous accounts of sudden subsidence while driving on old and unmarked burial grounds.

- Drawings of old facilities where the engineered information is not available, or not accurate.

DEFINE THE NEED:

The need involves a system that will be responsible, responsive, and reliable for intergeneration data.

Information that will identify site boundaries, surveillance systems, keep community aware with onsite markers, technical data (contaminates concern/design of site).

There needs to be a transition period from DOE to the steward regarding transfer of all project documents.

DEFINE THE CAPABILITIES:

We have written media (documentation package), organizational structure that maintains the information (i.e., tribe, county, emergency response group, etc...). This would need to be researched to keep and maintain community awareness, not losing the information; someone needs to come up with the preferred method of maintaining the media.

Must be able to develop an archives with photos, maps, administrative reports, blueprints, specifications, etc...

GOAL:

The goal is to maintain information which is simple, and long-term regardless of new technology media's (i.e., computer disks).

The information should protect drawings, identified boundaries, contaminates of concern... should be archived on acid-free hard copy for future reference as an example.

DEFINE THE TARGETS ACHIEVABLE BY 2008:

We need to technically define the basic information that will sustain LTS process for each site.

Who, what, where, and how is this information going to be maintained by the steward?

ARE THERE MULTIPLE TECNICAL APPROACHES?

Information Management
Packaging
Contracting with an outside organization to keep the information

WHAT IS THE STATUS OF TECHNICAL MATURITY?

The documentation package can be done to date, but protocol is essential information.

Consideration:
We need to plan for failure or disruption. If the safety system fails, someone in the future will need to be able to obtain relevant information for repairing the failure.

The LTS duties and responsibilities need to maintain and manage the pertinent information.

Responsible WG Member D. Stapp

SS&IC - LTS S&T Roadmap Target Form

Program Activity: Develop a finite number of generic, standardized, risk-based, efficient safety systems.

Technical Capability: Evaluate site-specific data and requirements.

Goal: [X] Reduce Cost [ ] Reduce Uncertainty [ ] Reduce Risk

Short-term(2008) Target: Identify commonalties among the sites to be closed (by 2006) to reduce cost by 40%.

Target Description: By 2003, a set of contaminant targets will be identified that represent the range of potential contaminants for three media (air, soil, groundwater) at the 2006 closure sites (Fernald, Mound, Rocky Flats, 6 smaller sites as yet unidentified). By identifying a set of targets, S&T efforts to develop safe, reliable and cost-effective contaminant detection instrumentation can be focused on those contaminants that will have the highest payoff to EM and benefit to potential communities at risk.

Target Status: [X] Process/Method Exists [ ] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification: Identifying the targets is central to development of the safety systems. Safety systems at a LTS site comprise various components:

- The organizational component created by the transfer agreement, which outlines roles and responsibilities, maintenance schedules, end-states, safety systems, liabilities, etc.
- The contaminant migration detection component involving devices for contaminants in air, soil, and water
- The engineered structure integrity assessment component
- The intrusion monitoring component for humans, plants and animals, and erosion
- The long-term (inter-generational) data management and analysis component
- Community alert component (e.g., green light on or off).

For the contaminant migration detection component, instrumentation needs to detect migration of hazardous materials beyond that predicted in the site conceptual model. The instruments must be simple, automated, reliable, and commensurate with the risk. Instrumentation is not needed for every contaminant, because certain contaminants have properties that make them easier to detect than others. These indicator contaminants, which we refer to as our “target” contaminants, can serve as proxies for all the risk contaminants at a site. By focusing on a finite number of detection systems for these target contaminants, the systems can be standardized, which will lower the cost; facilitate ease of operation, maintenance and repair; and engender community confidence.

Mid-term(2014) Target:

Target Description:

Target Status: [ ] Process/Method Exists [ ] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification:

Long-term(2020) Target:

Target Description:

Target Status: [ ] Process/Method Exists [ ] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification:

Work Group: Safety Systems and Institutional Controls (SS/IC)

Program Activity: Develop a finite number of generic, standardized, risk-based, efficient safety systems
Technical capability: Evaluate site-specific data and requirements
Target description: Identify commonalities among the sites to be closed (by 2006) to reduce cost by 40%

Goal:

By 2003, a set of contaminant targets will be identified that represent the range of potential contaminants for three media (air, soil, groundwater) at the 2006 closure sites (Fernald, Mound, Rocky Flats, 6 smaller sites as yet unidentified). By identifying a set of targets, S&T efforts to develop safe, reliable and cost-effective contaminant detection instrumentation can be focused on those contaminants that will have the highest payoff to EM and benefit to potential communities at risk.

Justification:

Identifying the targets is central to development of the safety systems. As shown in Figure 1, safety systems at a LTS site comprise various components:

- The organizational component created by the transfer agreement, which outlines roles and responsibilities, maintenance schedules, end-states, safety systems, liabilities, etc.
- The contaminant migration detection component involving devices for contaminants in air, soil, and water
- The engineered structure integrity assessment component
- The intrusion monitoring component for humans, plants and animals, and erosion
- The long-term (inter-generational) data management and analysis component
- Community alert component (e.g., green light on or off).

For the contaminant migration detection component, instrumentation needs to detect migration of hazardous materials beyond that predicted in the site conceptual model. The instruments must be simple, automated, reliable, and commensurate with the risk. Instrumentation is not needed for every contaminant, because certain contaminants have properties that make them easier to detect than others. These indicator contaminants, which we refer to as our "target" contaminants, can serve as proxies for all the risk contaminants at a site. By focusing on a finite number of detection systems for these target contaminants, the systems can be standardized, which will lower the cost; facilitate ease of operation, maintenance and repair; and engender community confidence.

Needs:

If we are to provide a range of alternative systems for a closure site manager and stakeholders to select from, the instrument systems need to represent the majority of contaminants and media in which they are found for the closure sites. Information about the sites to be closed in 2006 is needed; it will also be useful to identify commonalities among the majority of all sites to be closed to ascertain whether the 2006 sites are representative of the DOE-EM complex, and if not, where the difference are.

To identify those contaminants in the three media that can serve as the best indicators of contaminant migration, the contaminants found at the sites need to be evaluated in terms of physical properties to identify those that move the fastest and are most visible. Those contaminants with the best physical properties then need to be evaluated in the context of contaminant detection instrumentation technologies.

We have information about the top 24 contaminants that will exist in the soil and groundwater at the various LTS sites. According to the LTS Technical Baseline document, we know the following:

- 92% of the sites (843 of 921) are either soil ~470), engineered units (~220), or groundwater ~160)
- Approximately 90% of the planned stewardship activities are either access control (397), monitoring (364), institutional controls (349), groundwater monitoring (254), deed restrictions (156), cap monitoring and maintenance (123)
- The top 10 contaminants identified are VOC (~200 sites), SR-90 (~130 sites), U (~130 sites), H-3 (~110 sites), Pb (~100 sites), Co-60 (~100 sites), Cs-137 (~80 sites), Pu (~75 sites), U-238 (~75 sites), Cr (~75 sites)
- Within engineered structures, the top 10 contaminants (~90%) are, in order, Alpha, VOC, Other Metal, Uranium, EPA Toxic Metal, Beta-Gamma, Non-specified Radionuclides, High Explosive, Tritium, Other Organic
- Within groundwater, the top 10 contaminants (~90%) are, in order, VOC, Uranium, EPA Toxic Metal, Alpha, Other Inorganic, Other Metal, Tritium, Solvent, Beta-Gamma, Other Organic
- Within soils, the top 10 contaminants (~90%) are, in order, Alpha, EPA Toxic Metal, Beta-Gamma, Uranium, Other Metal, VOC, Other Inorganic, Solvent, PCB, Tritium

Can we identify a set of contaminant targets from which to pursue S&T? We must, because until we do, we will not be able to develop safe and reliable and low cost instrumentation systems to ensure adjacent communities that they are safe. Until we can assure communities that they will be safe, EM will have difficulty transferring LTS sites out of the EM Program.

As stated above, we have some data concerning the types of contaminants at the near-term closures. What we do not have readily at hand is a way to reduce the number of contaminants down to a select set of targets that will form the basis of the contaminant migration detection system. The concept is illustrated in Figure 2.

The Long Term Stewardship (LTS) [http://www.inel.gov/st-needs/needlist.asp?t=ltstew] website does not list a needs that relates to this technical capability.

Recommendations

1. Gather detailed information about contaminants at the 2006 sites (end states, contaminant concentrations, media).
2. Compare to the remainder of the closure sites to determine if the 2006 sites are generally representative or not. If not, a decision needs to be made whether to pursue the smaller set of near-term closures or the larger set of long-term closures.
3. Reduce the number of contaminants based upon based upon physical properties (e.g. vapor pressure, mobility) and technological considerations (e.g. xyz sensor can detect these contaminants).
4. Select the target contaminants for air, soil, and groundwater for which safe, reliable, and cost-effective detection instrumentation will be developed through the DOE-EM S&T LTS Program.

Draft Prepared: 2/27/02

Figure 1

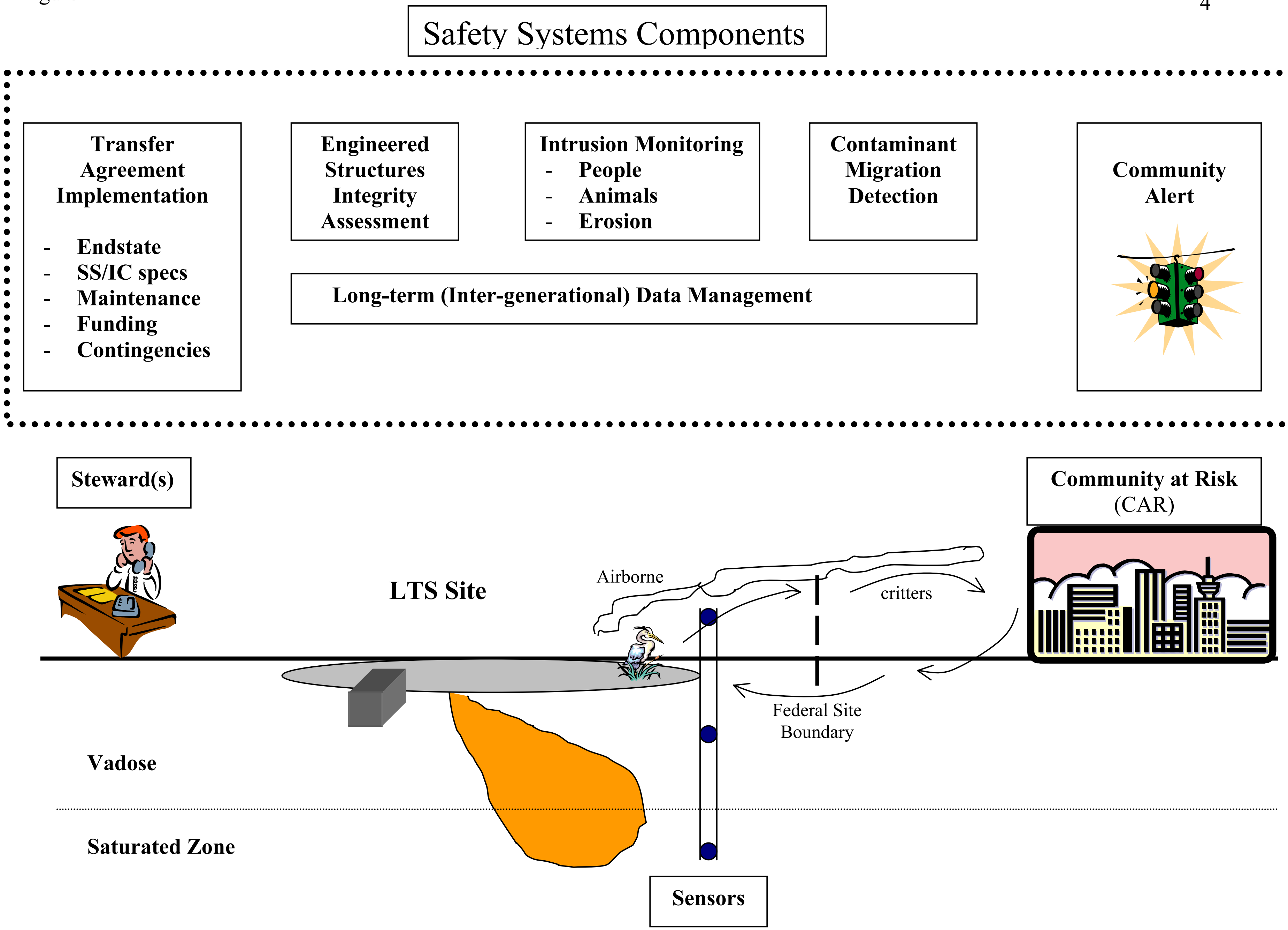
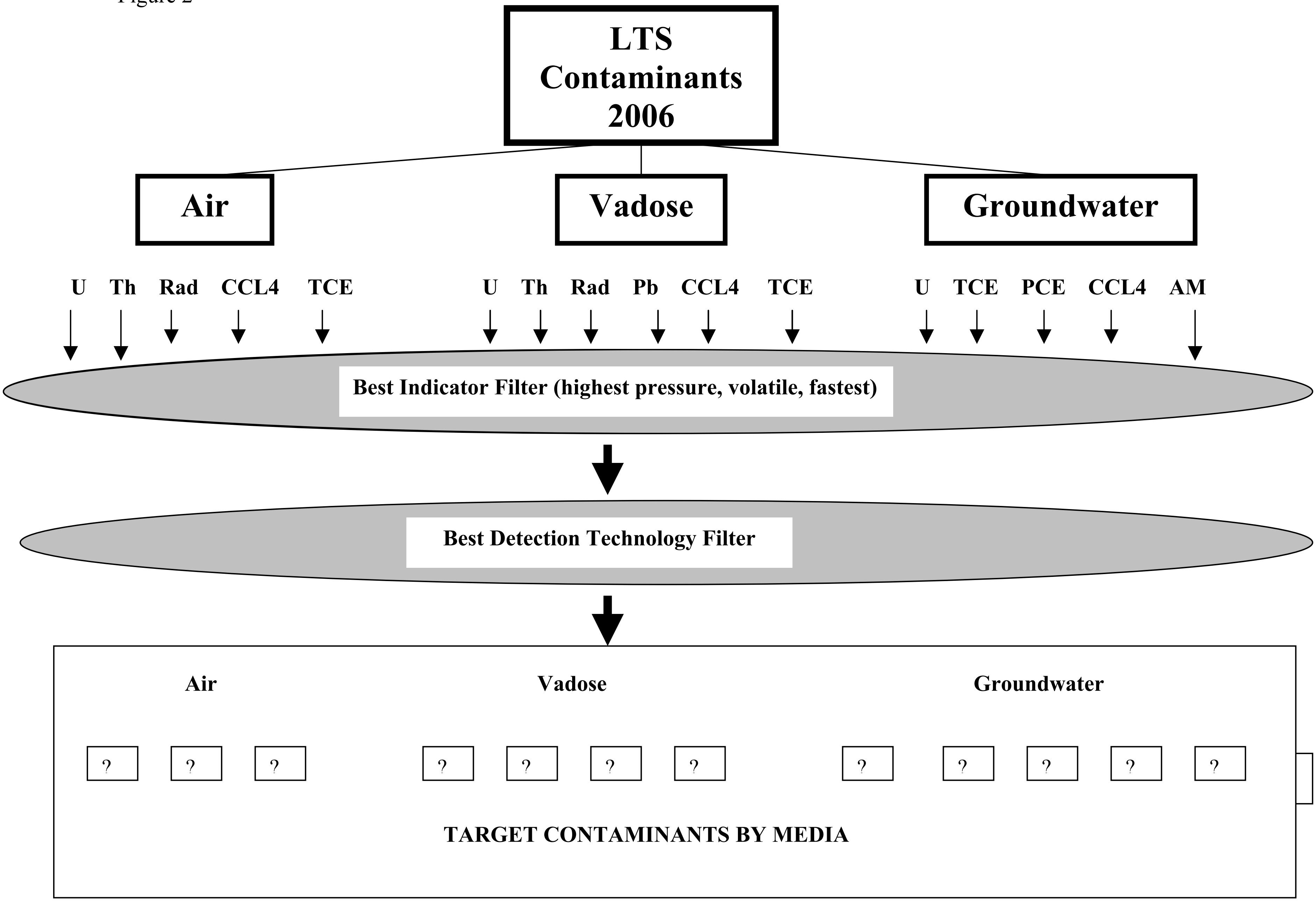

Safety Systems Components
Transfer Agreement Implementation
- Endstate
- SS/IC specs
- Maintenance
- Funding
- Contingencies
Engineered Structures Integrity Assessment
Intrusion Monitoring
- People
- Animals
- Erosion
Contaminant Migration Detection
Community Alert
Long-term (Inter-generational) Data Management
Steward(s)
Community at Risk (CAR)
LTS Site
Airborne
critters
Federal Site Boundary
Vadose
Saturated Zone
Sensors

Figure 2


LTS Contaminants 2006
Air
Vadose
Groundwater
U Th Rad CCL4 TCE
U Th Rad Pb CCL4 TCE
U TCE PCE CCL4 AM
Best Indicator Filter (highest pressure, volatile, fastest)
Best Detection Technology Filter
Air
Vadose
Groundwater
? ? ?
? ? ? ?
? ? ? ? ?
TARGET CONTAMINANTS BY MEDIA

Responsible WG Member D. French

SS&IC - LTS S&T Roadmap Target Form

Program Activity: Define legal strategies.

Technical Capability: Identify potential legal strategies.

Goal: ☐ Reduce Cost ☐ Reduce Uncertainty ☒ Reduce Risk

Short-term(2008) Target: Prepare guidance manual.

Target Description: By 2004, prepare a guidance manual that provides closure sites and EM50 with alternative land-use end-states and associated legal instruments. The manual will be instrumental in accelerating the seamless handoff of closed sites to the final end-use steward(s) and will provide the mechanism to ensure each site's LTS goals are met.

Target Status: ☐ Process/Method Exists ☒ Process/Method Being Pursued ☐ No Known Process/Method

Status Justification: A number of potential legal strategies currently exist regarding the transfer of the sites property and title, if appropriate, to the final steward of the site. However, a comprehensive guidance document of available legal options and benefits are not currently available.

Transferring LTS sites out of EM control is fundamental to getting EM out of the cleanup business. Yet, getting someone else to accept even partial responsibility for managing LTS site remains as one of the major stumbling blocks for the LTS Program. Liability concerns a fundamental to this problem, but so too are determinations of end-state, funding for O&M, funding for contingencies (i.e., unexpected problems), data management, and so on.

While the issues surrounding LTS site transfer are complex, a set number of strategies for effecting transfer can be developed. Indeed, approaches must be standardized to avoid each site endlessly negotiating with the potential steward(s) the myriad options available. The legal instruments effecting transfer of LTS sites out of EM control are also important because they will limit the number and range of LTS activities at a site. For example, transfer agreements will

- Implement safety system and institutional control technologies at LTS sites that are tightly focused and directed to be effective and efficient.
- Identify final end-state land-use and corresponding legal instruments to implement only necessary and sufficient technologies.
- Establish front end technology requirements (current and future) with end-state.

The benefits of these legal instruments will be:

- LTS costs, EM50 expenditures and closure costs will be significantly reduced,
- site closure plans will integrate cleanly into LTS goals and requirements,
- stakeholders will not be taken by surprise,
- duplication of efforts between closure activities and LTS activities will be reduced, and
- focusing dollars/development on actual known LTS end-state needs for safety systems and institutional controls.

To maximize these benefits, EM needs to provide LTS sites with a guidance manual that details the alternatives available for LTS site transfer. The manual will identify those discriminating factors that make certain transfer agreements more appropriate than others. By standardizing and restricting the number of transfer strategies, EM will be better able to manage the transfer. By providing examples of legal instruments for each approach, substantial time and expense can be spent preparing legal documents.

Mid-term(2014) Target:

Target Description:

Target Status: ☐ Process/Method Exists ☐ Process/Method Being Pursued ☐ No Known Process/Method

Status Justification:

Goal:

By 2004, prepare a guidance manual that provides closure sites and EM50 with alternative land-use end-states and associated legal instruments. The manual will be instrumental in accelerating the seamless handoff of closed sites to the final end-use steward(s) and will provide the mechanism to ensure each site's LTS goals are met.

Justification:

Transferring LTS sites out of EM control is fundamental to getting EM out of the cleanup business. Yet, getting someone else to accept even partial responsibility for managing LTS site remains as one of the major stumbling blocks for the LTS Program. Liability concerns are fundamental to this problem, but so too are determinations of end-state, funding for O&M, funding for contingencies (i.e., unexpected problems), data management, and so on.

While the issues surrounding LTS site transfer are complex, a set number of strategies for effecting transfer can be developed. Indeed, approaches must be standardized to avoid each site endlessly negotiating with the potential steward(s) the myriad options available.

The legal instruments effecting transfer of LTS sites out of EM control are also important because they will limit the number and range of LTS activities at a site. For example, transfer agreements will

- Implement safety system and institutional control technologies at LTS sites that are tightly focused and directed to be effective and efficient.
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- site closure plans will integrate cleanly into LTS goals and requirements,
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Key Points:

- Strategies for ensuring long-term funding of LTS is critical to being able to transfer LTS sites to a steward(s). No organization will accept full liability or responsibility without some guarantee that funding will be available for O&M and for contingencies if a problems occurs (e.g., contaminants begin to migrate and threaten a community at risk).
- The final end-state is central to determining requirements (institutional controls and safety systems) for facilities transitioning into LTS from closure and during the stewardship years.

Impacted Goals:

- The end-state determines the science/technology needed to achieve the LTS program targets.
- Cost savings of 50% or more on implemented LTS technologies expected by eliminating duplicative closure activities or closure activities that negatively impact LTS activities.
- Results
    - Improvement in the capability to define the LTS end-state land-use,
    - Reducing EM50 development costs for LTS systems,
    - High reduction in technical uncertainty (not developing or implementing low return or unnecessary technologies), and
    - Reduced risk for sites going into closure and then transitioning into the LTS program.

2008:

- Completed guidance manual by **2004**, full DOE use by **2006** and template for federal agencies by **2008**. Used by closure sites, organizations, e.g., ECOS, stakeholders and site stewards or trustees.

Maturity:

- Some documents are available, others need development. Independent state organizations are already involved. The goal is to develop creative legal instruments (where appropriate) and capture available information into a cohesive and understandable manual that can be employed by sites, state agencies, EM50 and others to help ensure only necessary and sufficient technologies are implemented and funded to achieve the LTS goals in coordination with site closure activities.

Responsible WG Member N. Brandon

SS&IC - LTS S&T Roadmap Target Form

Program Activity: Develop and maintain integrity of access control and safety systems.

Technical Capability: Collecting and analyzing data.

Goal: [X] Reduce Cost [ ] Reduce Uncertainty [ ] Reduce Risk

Short-term(2008) Target: Identify and develop automated safety systems to reduce life cycle cost of collecting and analyzing data by 60% by 2008.

Target Description:

Target Status: [ ] Process/Method Exists [X] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification: Payback on R&D. Use real time automated systems. Means of validating systems performance And design basis. Major uncertainty reduction. Quicker turnaround time for collection and analysis.

Mid-term(2014) Target:

Target Description:

Target Status: [ ] Process/Method Exists [ ] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification:

Long-term(2020) Target:

Target Description:

Target Status: [ ] Process/Method Exists [ ] Process/Method Being Pursued [ ] No Known Process/Method

Status Justification:

Activities / Capabilities	Impact by 2008	Impact beyond 2008	Targets: Short-term (2008)	Mid-term (2014)	Long-term (2020)	Resp. WG Member	
1. Develop a finite number of generic, standardized, risk-based, efficient safety systems							
1.1 Develop a methodology for safety systems selectior							1.1 Essential for closure plan. Air, ground, & water intrusion.
G1: reduce cost	High	High	Develop draft methodology by 2004 and final by 2006, which will reduce capitol and O&M costs by 40%			J. Mohatt/D. Johnson	G1: Standard systems should reduce costs, especially over long term. Reduce costs of operational costs. We have complex labor intensive systems. We need to reduce the labor intensive systems and reduce the complexity. New technologies in surrogate and NDA systems. Can monitor at the occupational exposure levels. Need it for the community at risk (24 hour).
G2: reduce technical uncertainty	High	High					
G3: reduce risk to public and environment	High	High					
1.2 Prepare a risk based monitoring strategy.							1.2 Consider/include mineral, floral, fauna
G1: reduce cost	High	High	Covered under 1.1				G1: Graded approach relative to hazards left behind.
G2: reduce technical uncertainty	Medium	Medium					
G3: reduce risk to public and environment	Negligible	Negligible					G3: In the absense of a risk based monitoring strategy one would expect a conservative default, therefore no reduction to risk
1.3 Design an Information Management Systen							
G1: reduce cost	Medium	High					G1: Technology continues to change making it difficult to standardize IMS by 2008. Separate consultants and software. Managed differently. Different platforms. Retrievability. Ability to communicate between platforms.
G2: reduce technical uncertainty	Medium	Medium					G2: Helps remove barriers
G3: reduce risk to public and environment	Negligible	Negligible					G3: Reduce perception of risk and provide quick communication. Short time to do correlation of data to do trend analysis of analytes. Early identification of issues will have some positive effect.
1.4 Evaluate site specific data and requirements (typology of site issues)							1.4 Need information on the sites to be closed by 2006 to identify common characterization data and needs.
G1: reduce cost	High	High	Identify commonalities among the sites to be closed (by 2006) to reduce cost by 40%.			D. Stapp	G1: Reduces overanalysis and overly conservative approach.
G2: reduce technical uncertainty	High	High					G2: Measure everything versus focused, efficient measuring. Optimal set of parameters or measures.
G3: reduce risk to public and environment	Negligible	Negligible					G3: Early warning trigger. Negligible for closure, however, it is important for LTS.
1.5 Identify restrictions on consumable resources.							1.5 Ability of area tribes/residents to consume the resources in the area.
G1: reduce cost	Negligible	Negligible					
G2: reduce technical uncertainty	Medium	Medium					G2: Helps remove barriers to allow other activities to move forward.
G3: reduce risk to public and environment	Medium	Medium					G3: Essential item for closure plans.
G2: reduce technical uncertainty							
G3: reduce risk to public and environment							
G3: reduce risk to public and environment							
2. Develop & maintain integrity of access control and safety systems.							
2.1 Design graded access control methods							2.1 Signs, boundary markers, dependent upon site's needs.
G1: reduce cost	Negligible	Negligible					G1: Not a lot to advance the state of art in short-term.
G2: reduce technical uncertainty	Negligible	Medium					G2: New technology may reduce uncertainty in long-term.
G3: reduce risk to public and environment	High	High					G3: Can be achieved short and long term.
2.2 Identify maintenance requirements and schedules							
G1: reduce cost	Medium	Medium	Optimize maintenance systems to reduce costs by 40% by 2008.			D. Paine	G1: Discipline. Not over maintaining. Risk of failure if you don't maintain, as well as a liability issue.
G2: reduce technical uncertainty	High	High					G2: Defendability in maintained system. Data quality objective (DQO).
G3: reduce risk to public and environment	High	High					G3: Failure to maintain and follow schedules. affects reliability of systems.
2.3 Collect and analyze data.							
G1: reduce cost	High	High	Identify and develop automated safety systems to reduce life cycle cost of collecting and analyzing data by 60% by 2008.			N. Brandon	G1: Payback on R&D. Use real time automated systems.
G2: reduce technical uncertainty	High	High					G2: Means of validating systems performance and design basis. Major uncertainty reduction.
G3: reduce risk to public and environment	High	High					G3: Quicker turnaround time for collection and analysis. Real time or near real time versus current state.

2.4 Define strategy for emergency preparedness for LTS							
G1: reduce cost	Negligible	Negligible					G1: Emergencies are less of an issue due to well developed state.
G2: reduce technical uncertainty	Negligible	Negligible					G2: Technology is mature.
G3: reduce risk to public and environment	Medium	Medium					G3: Unlikely of an immediate risk to public or environment. Define the community at risk (boundary). Greatest risk in inappropriate resonse from emergency personnel.
2.5 Assess potential terrorist threats							
G1: reduce cost	Negligible	Negligible					G1: Increases cost
G2: reduce technical uncertainty	Negligible	Negligible					G2: Unpredictable
G3: reduce risk to public and environment	Negligible	Negligible					G3: Unpredictable
3. Optimize operational and technical management and administration.							Look at bells and whistles to get LTS established at the sites, including legal, cultural, and hardware requirements. Intrusion detectors. Microwave stations. Communication systems.
3.1 Validate overall (technical/non-technical) system performance.							3.1 Validate the criteria established in section 1.1.
G1: reduce cost	Medium	High					G1: Reduces potential liability and reduces liability costs in the long term.
G2: reduce technical uncertainty	**High**	High					G2: See 2.3 Continues to ensure reliability of the system.
G3: reduce risk to public and environment	**High**	High					G3: Continues to ensure reliability of system.
3.2 Estimate, track, and measure cost							
G1: reduce cost	Negligible	Negligible					G1: Project Management/Administrative process
G2: reduce technical uncertainty	Negligible	Negligible					
G3: reduce risk to public and environment	Negligible	Negligible					
3.3 Interact with stakeholders to define system requirements and communicate program effectiveness							
G1: reduce cost	Medium	Negligible					G1: Could be cost avoidance issue if it is done upfront. System may be compromised if stakeholders are not involved.
G2: reduce technical uncertainty	Medium	Medium					G2: Reduces stakeholder's perception of technical uncertainty. Stakeholder involvement reduces barriers.
G3: reduce risk to public and environment	**High**	High					G3: High importance to stakeholders.
3.4 Maintain intergenerational database and respond as necessary.							3.4 Composit of necessary information that will be passed on to other generations. Critical to maintain data.
G1: reduce cost	**High**	High					G1: Develop maps on archival paper and placed in repository with assigned responsibility (CERCLA library-administrative record). Tribal communities maintain data. Religious Institutions.
G2: reduce technical uncertainty	**High**	High	Develop options for ensuring the preservation of site information from generation to generation to ensure technica continuity and reduce uncertainty.			K. Peone	
G3: reduce risk to public and environment	**High**	High					
G1: reduce cost							
G2: reduce technical uncertainty							
G3: reduce risk to public and environment							
4. Define Legal Strategy			By 2004, prepare a guidance manual of potential legal strategies and associated instruments to facilitate handoff of closed sites to final steward.			D. French	#NAME?
4.1 Identify potential legal strategies (various depending upor State, etc.)							4.1 National wildlife refuge, local control, transfer to states/local communities, buffer zones,
G1: reduce cost	Medium	Medium					
G2: reduce technical uncertainty	Negligible	Negligible					
G3: reduce risk to public and environment	**High**	High					
4.2 Develop alternative legal draft instruments.							4.2 Designated stewards could use these draft instruments as templates.
G1: reduce cost	Medium	Medium					
G2: reduce technical uncertainty	Negligible	Negligible					
G3: reduce risk to public and environment	**High**	High					
4.3 Assess established agreements							
G1: reduce cost	Medium	Medium					
G2: reduce technical uncertainty	Negligible	Negligible					
G3: reduce risk to public and environment	**High**	High					
4.4 Prepare Guidance Manual							4.4 Guidance manual to handoff to sites.
G1: reduce cost							
G2: reduce technical uncertainty							
G3: reduce risk to public and environment							
G1: reduce cost	Medium	Medium					
G2: reduce technical uncertainty	Negligible	Negligible					
G3: reduce risk to public and environment	**High**	High					

Long-Term Stewardship
Science and Technology Roadmap

Safety Systems & Institutional Controls

Long-Term Stewardship
Science and Technology Roadmap

Work Group Members

James Mohatt (Chair)	**JVM and Associates**
Norm Brandon	**Creative Concepts**
David French	**Aspen Resources**
David Johnson	**University of Oklahoma Health Science Center**
Donald Paine	**Nuclear Fuel Service, Inc.**
Kimberly Peone	**Critical Data Tribal, LLC**
Darby Stapp	**Pacific Northwest National Laboratory**

Safety Systems & Institutional Controls Working Group

Vision Statement

By 2008 implement science and technologies needed for responsible, responsive, and reliable institutional controls and safety systems for Long Term Stewardship of DOE facilities.

Assumptions

- A barrier will be in place with some form of monitoring in place.
- The closure plan will have characterized significant contaminants.

LTS Issues

- **The LTS plan must be in place prior to the closure of the sites.**
- **DOE needs a strategy for the transfer of ground rules. (Recipient/purveyor)**
- **New legislation is needed to establish and ensure the LTS program. (Congressional Act)**
- **Maintaining long-term land use control. (Legal is one possibility)**

Process Issues

- **Pre-meeting on Sunday, January 27th.**
  - Draft Vision Statement
  - Committee Introduction
  - Issues (Long-Term & Short-term)
- **The Safety Systems &Institutional Controls Team followed the written DOE R&D goals as it related to LTS.**
- **Interface meeting with Decision Making and Institutional Performance Team.**
  - Clarified Respective Roles
  - Most Useful

Process Issues (cont.)

Long-Term Stewardship Science and Technology Roadmap

- **Many of the issues were critical to the long-term; however, only the following qualified for the short-term (2008).**

SS&IC - Activity 1

Long-Term Stewardship Science and Technology Roadmap

Activities / Capabilities	Impact by 2008	Impact beyond 2008	Targets: Short-term (2008)	Targets: Mid-term (2014)	Targets: Long-term (2020)
1. Develop a finite number of generic, standardized, risk-based, efficient safety systems					
1.1 Develop a methodology for safety systems selection					
G1: reduce cost	**High**	High	Develop draft methodology by 2004 and final by 2006, which will reduce capitol and O&M costs by 40%		
G2: reduce technical uncertainty	**High**	High			
G3: reduce risk to public and environment	**High**	High			
1.2 Prepare a risk based monitoring strategy.					
G1: reduce cost	**High**	High	Covered under 1.1		
G2: reduce technical uncertainty	Medium	Medium			
G3: reduce risk to public and environment	Negligible	Negligible			
1.3 Design an Information Management System					
G1: reduce cost	Medium	High			
G2: reduce technical uncertainty	Medium	Medium			
G3: reduce risk to public and environment	Negligible	Negligible			
1.4 Evaluate site specific data and requirements (typology of site issues)					
G1: reduce cost	**High**	High	Identify commonalities among the sites to be closed (by 2006) to reduce cost by 40%.		
G2: reduce technical uncertainty	**High**	High			
G3: reduce risk to public and environment	Negligible	Negligible			
1.5 Identify restrictions on consumable resources.					
G1: reduce cost	Negligible	Negligible			
G2: reduce technical uncertainty	Medium	Medium			
G3: reduce risk to public and environment	Medium	Medium			
G2: reduce technical uncertainty					
G3: reduce risk to public and environment					
G3: reduce risk to public and environment					

SS&IC - Activity 1 *(cont)*

Activity 1: Develop a finite number of generic, standardized, risk-based, efficient safety systems

Capability: Develop methodology for safety systems selection

– Target: Develop draft methodology by 2004 and final by 2006, which will reduce capitol and O&M costs by 40%.

SS&IC - Activity 1 *(cont)*

Activity 1: Develop a finite number of generic, standardized, risk-based, efficient safety systems

– Capability: Evaluate site specific data and requirements (typology of site issues)

– Target: Identify commonalities among the sites to be closed (by 2006) to reduce cost by 40%.

SS&IC - Activity 2

Activities / Capabilities	Impact by 2008	Impact beyond 2008	Targets: Short-term (2008)	Mid-term (2014)	Long-term (2020)
2. Develop & maintain integrity of access control and safety systems.					
2.1 Design graded access control methods.					
G1: reduce cost	Negligible	Negligible			
G2: reduce technical uncertainty	Negligible	Medium			
G3: reduce risk to public and environment	High	High			
2.2 Identify maintenance requirements and schedules.					
G1: reduce cost	Medium	Medium	Optimize maintenance systems to reduce costs by 40% by 2008.		
G2: reduce technical uncertainty	High	High			
G3: reduce risk to public and environment	High	High			
2.3 Collect and analyze data.					
G1: reduce cost	High	High	Identify and develop automated safety systems to reduce life cycle cost of collecting and analyzing data by 60% by 2008.		
G2: reduce technical uncertainty	High	High			
G3: reduce risk to public and environment	High	High			
2.4 Define strategy for emergency preparedness for LTS					
G1: reduce cost	Negligible	Negligible			
G2: reduce technical uncertainty	Negligible	Negligible			
G3: reduce risk to public and environment	Medium	Medium			
2.5 Assess potential terrorist threats.					
G1: reduce cost	Negligible	Negligible			
G2: reduce technical uncertainty	Negligible	Negligible			
G3: reduce risk to public and environment	Negligible	Negligible			

SS&IC - Activity 2 *(cont)*

Activity 2: Develop & maintain integrity of access control and safety systems.

- Capability: Identify maintenance requirements and schedules.

- Target: Optimize maintenance systems to reduce costs by 40% by 2008.

SS&IC - Activity 2 *(cont)*

Activity 2: Develop & maintain integrity of access control and safety systems.

- Capability: Collect and analyzing data.

- Target: Identify and develop automated safety systems to reduce life cycle cost of collecting and analyzing data by 60% by 2008.

SS&IC - Activity 3

Activities / Capabilities	Impact by 2008	Impact beyond 2008	Targets: Short-term (2008)	Targets: Mid-term (2014)	Targets: Long-term (2020)
3. Optimize operational and technical management and administration.					
3.1 Validate overall (technical/non-technical) system performance.					
G1: reduce cost	Medium	High			
G2: reduce technical uncertainty	High	High			
G3: reduce risk to public and environment	High	High			
3.2 Estimate, track, and measure cost.					
G1: reduce cost	Negligible	Negligible			
G2: reduce technical uncertainty	Negligible	Negligible			
G3: reduce risk to public and environment	Negligible	Negligible			
3.3 Interact with stakeholders to define system requirements and communicate program effectiveness.					
G1: reduce cost	Medium	Negligible			
G2: reduce technical uncertainty	Medium	Medium			
G3: reduce risk to public and environment	High	High			
3.4 Maintain intergenerational database and respond as necessary.					
G1: reduce cost	High	High			
G2: reduce technical uncertainty	High	High	Develop options for ensuring the preservation of site information from generation to generation to ensure technical continuity and reduce uncertainty.		
G3: reduce risk to public and environment	High	High			
G1: reduce cost					
G2: reduce technical uncertainty					
G3: reduce risk to public and environment					

SS&IC - Activity 3 *(cont)*

Long-Term Stewardship Science and Technology Roadmap

Activity 3: Optimize operational and technical management and administration.

– Capability: Maintain intergenerational database and respond as necessary.

– Target: Develop options for ensuring the preservation of site information from generation to generation to ensure technical continuity and reduce uncertainty.

SS&IC - Activity 4

Long-Term Stewardship Science and Technology Roadmap

Activities / Capabilities	Impact by 2008	Impact beyond 2008	Targets: Short-term (2008)	Mid-term (2014)	Long-term (2020)
4. Define Legal Strategy			By 2004, prepare a guidance manual of potential legal strategies and associated instruments to facilitate handoff of closed sites to final steward.		
4.1 Identify potential legal strategies (various depending upon State, etc.)					
G1: reduce cost	Medium	Medium			
G2: reduce technical uncertainty	Negligible	Negligible			
G3: reduce risk to public and environment	High	High			
4.2 Develop alternative legal draft instruments.					
G1: reduce cost	Medium	Medium			
G2: reduce technical uncertainty	Negligible	Negligible			
G3: reduce risk to public and environment	High	High			
4.3 Assess established agreements.					
G1: reduce cost	Medium	Medium			
G2: reduce technical uncertainty	Negligible	Negligible			
G3: reduce risk to public and environment	High	High			
4.4 Prepare Guidance Manual					
G1: reduce cost					
G2: reduce technical uncertainty					
G3: reduce risk to public and environment					
G1: reduce cost	Medium	Medium			
G2: reduce technical uncertainty	Negligible	Negligible			
G3: reduce risk to public and environment	High	High			

SS&IC - Activity 4 *(cont)*

Long-Term Stewardship Science and Technology Roadmap

Activity 4: Define Legal Strategy

Note: Defining legal strategy will address funding, liability, stewardship, intergenerational issues.

– Target: By 2004, prepare a guidance manual of potential legal strategies and associated instruments to facilitate handoff of closed sites to a final steward.